



AD A 030805

SRI Project 2358

Technical Note

SSC-TN-2358-3

December 1974

Final

DEFENSE RDT&E PLANNING AND STRATEGY PARAMETERS: METHODOLOGICAL CONSIDERATIONS

By: RONALD C. WAKEFORD

Contributing Authors:

JOHN C. SCHARFEN
HAZEL T. ELLIS
THE MARTIN MARIETTA CORPORATION (Subcontractor)
WILLIAM W. PERRY (Consultant)

Prepared for:

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
1400 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22209

CONTRACT DAHC15-73-C-0183

ARPA Order No. 2289

Approved for public release; distribution unlimited.

97
RECEIVED
OCT 18 1974
C

STRATEGIC
STUDIES
CENTER



STANFORD
RESEARCH
INSTITUTE

SRI Project 2358

Technical Note
SSC-TN-2358-3

December 1974
Final

**DEFENSE RDT&E PLANNING AND STRATEGY
PARAMETERS:
METHODOLOGICAL CONSIDERATIONS**

By: RONALD C. WAKEFORD

Contributing Authors:

JOHN C. SCHARFEN
HAZEL T. ELLIS
THE MARTIN MARIETTA CORPORATION (Subcontractor)
WILLIAM W. PERRY (Consultant)

Prepared for:

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
1400 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22209

CONTRACT DAHC15-73-C-0183

ARPA Order No. 2289

Approved:

Richard B. Foster, Director
Strategic Studies Center

Approved for public release; distribution unlimited.

A

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
1. REPORT NUMBER SSC-TN-2358-3	2. GOVT ACCESSION NO. <i>and</i>	3. RECIPIENT'S CATALOG NUMBER <i>9 Final Rept.</i>	
4. TITLE (and Subtitle) DEFENSE RDT&E PLANNING AND STRATEGY PARAMETERS: METHODOLOGICAL CONSIDERATIONS.		5. TYPE OF REPORT & PERIOD COVERED Technical Note	
7. AUTHOR Ronald C. Wakeford		6. PERFORMING ORG. REPORT NUMBER N/A	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Stanford Research Institute, Strategic Studies Center, 1611 N. Kent Street, Arlington, VA 22209		8. CONTRACT OR GRANT NUMBER(s) DAHC15-73-C-0183, ✓ ARPA Order -2289	
11. CONTROLLING OFFICE NAME AND ADDRESS Defense Advanced Research Projects Agency 1400 Wilson Boulevard Arlington, Virginia 22209		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS SRI Project 2358	
14. MONITORING AGENCY NAME & ADDRESS (if diff. from Controlling Office) Defense Supply Service-Washington Room 1D245, The Pentagon Washington, D.C. 20310		12. REPORT DATE Dec 74	
		13. NO. OF PAGES 73	
16. DISTRIBUTION STATEMENT (of this report) Approved for Public Release; Distribution Unlimited		15. SECURITY CLASS. (of this report) Unclassified	
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from report) N/A		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A	
18. SUPPLEMENTARY NOTES N/A			
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) NATIONAL DEFENSE RESEARCH MANAGEMENT STRATEGY SECURITY <i>16 SRI-2358</i>			
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report reviews the recent changes in the global political, economic, and military environment to determine where modifications are warranted in the defense RDT&E planning process to incorporate reformulated national security goals. The report examines the relationship between such parameters as defense goals and guidelines, assessments, and objectives and introduces a methodology with which to improve the RDT&E planning process.			

DD FORM 1473
1 JAN 73
EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

19 KEY WORDS (Continued)

20 ABSTRACT (Continued)

ABSTRACT

This report reviews the recent changes in the global political, economic, and military environment to determine where modifications are warranted in the defense RDT&E planning process to incorporate reformulated national security goals. The report examines the relationship between such parameters as defense goals and guidelines, assessments, and objectives and introduces a methodology with which to improve the RDT&E planning process.

DISCLAIMER

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Defense Advanced Research Projects Agency or the U.S. Government.

CONTRACTUAL TASKS

This Technical Note is in partial fulfillment of Contract DAHCl5-73-C-0183.

FOREWORD

This study is an element of the research program for the Defense Advanced Research Projects Agency (ARPA) and is concerned with the development of RDT&E planning and strategy parameters. It is a complementary task to such other ARPA sponsored research as the analysis of defense R&D issues, technology transfer, and studies of Soviet strategy. The study is concerned with an analysis of the international and domestic trends which impact upon future defense planning and the introduction of appropriate goals and guidelines to stimulate the RDT&E planning process. The scope of the effort required a broad understanding of the many factors influencing the planning process; to this end a series of input papers were prepared to further the analysis. These are contained in Appendices A through E of this report. The appended input papers include discussions of:

- Defense Planning Guidelines
- A Description of the Formal DOD RDT&E System
- Defense RDT&E Policies
- Defense R&D Objectives
- RDT&E Constraining Factors

The Project Leader was Ronald C. Wakeford who was supported in the research effort by William W. Perry (Consultant), John C. Scharfen, and Hazel T. Ellis as well as other staff members and consultants of the SSC.

Richard B. Foster
Director
Strategic Studies Center

CONTENTS

ABSTRACT	iii
FOREWORD	v
LIST OF ILLUSTRATIONS	ix
LIST OF TABLES	ix
I INTRODUCTION	1
II RESEARCH APPROACH	3
A. General	3
B. Study Tasks	3
C. Study Outputs	5
III FOREIGN POLICY AND DEFENSE GUIDELINES	7
IV DEFENSE PLANNING SYSTEMS	21
A. Force Planning	21
1. Net Assessment	21
2. Total Force Planning	22
3. Long-Range Defense Planning	24
B. RDT&E Planning	24
C. Defense Planning Relationships	29
V STRATEGY PARAMETERS AND TOTAL R&D PLANNING	33
A. Defense and RDT&E Goals	33
B. Assessments and Constraints	37
1. Net RDT&E Assessment	33
2. Constraining Factors	46
C. R&D Objectives	46
D. Total RDT&E Planning	51
VI NEW DIRECTIONS IN DEFENSE R&D PLANNING	55

ILLUSTRATIONS

1	Relationship and Flow of Study Tasks	4
2	Formulation of R&D Objectives in the PPBS Cycle	26
3	RDT&E Parameters and Planning Factors	34
4	Mission Assessment	39
5	Technological Assessment	41
6	Resource Assessment	43
7	Organizational Assessment	45
8	Force RDT&E Planning Relationships	56
9	Strategy Planning Parameters for RDT&E	57

TABLES

1	Goals and Guidelines for Defense Planning	18
2	Mission Objectives	48
3	Supporting Objectives	50

I INTRODUCTION

Recent changes in the global political, economic and military environment suggest that modifications have to be incorporated into the national security planning process. While planning mechanisms have been modified and amended, the question arises whether the cumulative effect of recent events is not now so extensive as to warrant an appraisal of current plans and a reformulation of the planning system to coincide more accurately with future defense needs. Recent changes in the international environment include:

- A revamping of top-level national strategy in response to economic difficulties with attendant political-military repercussions in the West and Japan.
- The extensive shift in military power in favor of the USSR and the consequent changes in threat.
- Increased tension and crises in the Middle East.
- The introduction of new policies to establish detentes and treaties and controlling the deployment and use of strategic nuclear weapons.
- A deterioration of the partnership role of allies at a time of increased need for cooperation.

The principal changes in the domestic environment include:

- Deterioration in the national economy, increasing inflation, and trends toward a diminishing defense budget.
- A restaffing of DOD senior positions, administration and Congressional changes, and the concomitant revised interpretations of defense roles and missions.
- An extensive shift in U.S. public and Congressional attitude toward defense and military technology.
- A growing problem of basic resource scarcities including energy and raw materials.

The above factors and others impact on the optimum use of R&D resources by DOD, so it is necessary to examine and assess the derivation of R&D goals, processes, and planning procedures for strengths and weaknesses vis-a-vis this changed environment. A planning strategy for the achievement of defense and RDT&E goals must be developed and assessed with regard to its contribution to national security in the new milieu. This report examines the methodological considerations that must be assimilated in the development of an improved defense RDT&E planning system.

II RESEARCH APPROACH

A. General

The research of defense RDT&E planning strategies, reported herein, focuses on three objectives:

1. The identification of the key parameters involved in the formulation of RDT&E strategy, to include defense goals and guidelines, RDT&E goals and objectives, and evaluation criteria.
2. The identification and evaluation of the key RDT&E planning issues.
3. The derivation of an RDT&E planning methodology in keeping with recent changes in political, economic and military environment.

B. Study Tasks

The study approach consists of four tasks as outlined below and related in Figure 1.

- Task 1 is concerned with the assessment and synthesis of national security factors to support the development of defense planning guidelines. This task encompassed a comprehensive review of those global and domestic interactions which are the primary influence or principal drive to the development of national security policy and are the catalyst for military force planning. The effort drew heavily from current and recent SSC work, is representative of SSC assessments of the United States and adversary national postures, and results in the formulation of defense planning guidelines for future military forces.
- Task 2 summarizes current defense RDT&E policies and the key issues surrounding these policies. The policies considered were categorized as requirements policies, functional division policies, cooperative policies, program implementation policies, program management policies and performer policies. Each of these policies will be analyzed to determine (1) the principal activities currently associated with the policy and, where discernible, the resources

RELATIONSHIP & FLOW OF STUDY TASKS

Task 1

Develop defense guidelines from an assessment of global political, economic, and military force interactions

Task 2

Review current RDT&E policy and derive data on present status and rationale and the key issues associated with policy elements

Task 4

Perform an analysis of the compatibilities/incompatibilities between defense planning guidelines, RDT&E policies and issues and constraining factors and devise an RDT&E planning methodology

Task 3

Identify the key issues which inhibit the integration of defense RDT&E into national security planning

Summarize findings on the major considerations which impact the formulation of an RDT&E strategy

FIGURE 1

allocated in terms of funds, manpower, and organization, (2) the current issues associated with the policy as expressed by administration officials or the Congress, or debated between them, and (3) the rationale used in the formulation or updating of the policies being considered.

- Task 3 consists of the analysis of key problems in integrating defense RDT&E into national security planning. Issues examined include the deterrent role of technology with regard to general purpose forces, the rationale of technological superiority as opposed to technological balance, the role of R&D in international cooperation, the role of technology surprise in R&D planning, the value of NTA methodology in R&D planning, the value of "negotiating bargaining chips" as a rationale for R&D programs, the impact of technology transfer on national security, and the implications of short wars on defense R&D.
- Task 4 involves the analysis and integration of Tasks 1, 2, and 3 to expose the compatibilities/incompatibilities between current R&D planning and national goals and objectives to provide a rationale for the development of an updated RDT&E planning strategy. The components of analysis were (1) defense guidelines derived from SSC analyses, (2) current defense RDT&E policy and constraining factors, and (3) key issues in integrating defense RDT&E into national security policy.

C. Study Outputs

The study outputs are documented in two reports. These are:

1. Defense RDT&E Planning and Strategy Parameters: Methodological Considerations. This report contains an analysis and findings on the major parameters affecting the development of defense RDT&E planning strategy.
2. Key Issues in Defense R&D Planning. This report, which is published under separate cover, contains an analysis of the key issues which impact RDT&E strategy formulation, and cause shifts in defense and RDT&E policy.

III FOREIGN POLICY AND DEFENSE GUIDELINES

The role of defense RDT&E planning is most appropriately expressed in terms of the relationship it bears to national security and foreign policy planning and more specifically to defense guidelines. As a mechanism for improving military operational capability it plays a major, if not dominant, role in the development of the future national security posture. In the national strategy arena, progress in defense RDT&E often stimulates changes in foreign or domestic policy as its "high technology" impact reverberates throughout the world. The purpose of this section of the report is to examine the key relationships between U.S. foreign policy and defense guidelines to discern and describe any desirable modifications that are occasioned by changes in the international and domestic environments.

National security planning derives from analyses of the political, military and economic interactions among countries whose postures, or changes in posture, significantly affect power relationships between the United States and other nations. Before proceeding with a discussion of the present national security planning procedures and goals, it is of value to trace the progress of foreign policy formulation through the past three decades to discern trends, and the impact of these trends, upon R&D planning. Accordingly, the evolution of U.S. military strategy from 1953 to March of 1971, which was cited by Secretary Laird in a report to Congress,¹ is discussed below.

In brief, the 1953-1960 Eisenhower era was characterized by strategies of collective security and massive retaliation. Each was an innovative

¹ Melvin R. Laird, Secretary of Defense, Statement on the Fiscal Year 1972-76 Defense Program and the 1972 Defense Budget Before the House Armed Services Committee (9 March 1971).

concept of the United States and a significant departure from historical precedent. The concept of collective security was based on the threat perceived by the United States of Russian territorial and ideological expansion. Massive retaliation was based on strategic dominance (and later, strategic superiority) over Soviet forces. The limited NATO general purpose forces functioned, to some degree, as a trip wire for the release of nuclear forces. The strategy was based almost exclusively on deterrence as there was an extremely limited U.S. capability relative to Soviet strength except in strategic weapons. European and, to a much more limited extent, Asian allies as well relied upon the deterrence afforded by the U.S. nuclear umbrella.

The 1961-1968 Kennedy-Johnson era was characterized by strategies of flexible response and assured destruction. While the assured destruction concept was not immediately embraced by the Kennedy administration, for the better part of this period it was the fundamental precept of nuclear strategy. Assured destruction was adopted in lieu of its antithesis, counterforce, which was believed to be destabilizing and to imply that advocates were seeking a first strike capability. Flexible response was introduced to broaden the president's options, to reduce dependence upon a trip-wire strategy, to provide a credible general purpose force capability for a wide range of options, to reinforce a nuclear fire break strategy (the antithesis to continuum of force strategy) and, in the rhetoric of the day, "to put the nuclear genie back in the bottle." The basic premise of the strategy remained deterrence.

The Nixon Doctrine, first enunciated as a "Strategy for Peace", was based on three basic principles: partnership, strength and negotiation. From the very earliest Nixon interpretations of strategy, there was an emphasis on flexibility which implied a renunciation of exclusive reliance upon assured destruction: "I must not be--and my successors must not be--limited to the indiscriminate mass destruction of enemy civilians as the sole possible response to challenges."¹

¹

Richard M. Nixon, "U.S. Foreign Policy for the 1970s: Building for Peace," Report to the Congress, Volume II, p. 170 (25 February 1971).

The nuclear strategy was described as a doctrine of strategic sufficiency with "sufficiency" having two meanings: enough force to deter and enough force to insure that the United States and its allies could not be "black-mailed." These initial pronouncements were carefully worded, however, to avoid giving the Soviets the impression that sufficiency and reevaluation of assured destruction connoted an intention that the United States was threatening a disarming attack. With the deployment characteristics of the SLBM, and the prospect of other air and ground platforms, the near-term capability of either adversary to launch a disarming first-strike attack diminishes.

In his February 1974 report to the Congress, Defense Secretary Schlesinger enunciated what has been described as a new policy. "Looking ahead, I already have directed the addition of more deterrent options than we have previously had available for our strategic nuclear forces, and such modifications in targeting doctrine as might be necessary to achieve them."¹ The reference to countervalue targeting may not be as much a departure from established strategic procedures as may be thought. As indicated previously, President Nixon as early as 1971 stated that he was seeking a new flexibility in nuclear strategy and renouncing assured destruction as a sole possible response. The limited modernization program initiated in FY75 to improve missile accuracy and yield would also have been warranted on the basis of Soviet programs to harden missile sites. The inferences of a change in strategy therefore may have been stimulated not because there was a significant change in policy but because there was a requirement to modernize certain aspects of the strategic force.

In his 3 May 1973 report to the Congress, the President noted:

The impact of unconstrained technological developments in particular must be considered. On the one hand, both sides will want to ensure

¹

James R. Schlesinger, Secretary of Defense, Statement Before the Senate Armed Services Committee on the FY1975 Defense Budget and the FY1974 Supplemental Budget Request (5 February 1974).

that their forces can be modernized. They will want confidence in the reliability of their forces and their survivability in the foreseeable strategic circumstances. On the other hand, if competition in technology proceeds without restraint, forces capable of destroying the retaliatory forces of the other side could be developed; or the thrust of technology could produce such a result without deliberate decisions. Competition could inexorably intensify to the point that there could be a high premium on striking first.

In reviewing our strategic nuclear posture it is important to consider long-term goals as opposed to minor perturbations in strategy which are intended to serve short-term needs.

In this instance, the short-term negotiation goal of achieving an arms limiting agreement during the SALT II discussions assumes major importance in the minds of defense strategists. The Russian perception of U.S. intent was obviously important in the recent negotiations. They apparently perceived that the United States was embarking upon an expensive, technologically superior strategic force modernization program which stimulated them to agree upon the placement of a cap upon both delivery systems and the number of MIRVed missiles. The United States was thus given "bargaining chips" at the conference table, which provided political (in addition to military) relevance to the strategic offensive R&D program activities. Hence, the short- and long-term aspects of military strategy engender a perceptible impact upon defense R&D; in this instance both the "research" and "development" elements of the program would be in consonance.

The broad U.S. national security related aspects of current national strategy can be expressed as:

- The strategic policy of the United States is defensive relying on deterrence as a fundamental concept. To this end, the United States seeks a balanced defense between conventional and nuclear forces, both strategic and tactical, to afford a prudent degree of flexibility.
- The strategy is designed to facilitate negotiations on the limitation of both strategic nuclear arms and conventional forces while insuring the security of the United States and its allies.

- Military force planning provides that there be, in the event of a failure of deterrence, an effective warfighting capability capable of serving options designed to facilitate early war termination on terms which are not unfavorable to the United States or its allies. Flexibility is afforded in the identification of both tactical and strategic targets to give the President a wide range of options.
- Conventional force strategy emphasizes the ability to defend against conventional aggression; however, the use of tactical nuclear weapons remains an important option in such circumstances. The strategy provides sufficient ambiguity to reinforce deterrence. The concept of a continuity of forces requires the forward deployment of tactical nuclear weapons with forces equipped, trained and deployed to fight in a tactical nuclear environment.
- The strategy emphasizes the partnership aspects of U.S. military alliances requiring allied nations to provide a full measure of support to the defense of their own national interests with the United States providing leadership and selected military, economic, or political catalysts to strengthen desired relationships.
- Finally, the strategy recognizes the special requirements and concerns of its major European allies regarding a devastating nuclear or prolonged conventional war on the Continent. Therefore, nuclear guarantees under the terms of existing treaties and agreements have been restated and verified in foreign policy reports to the Congress.

Since the early 1970s, planning to meet these military elements of strategy stemmed largely from the strength, partnership and negotiations rubrics of U.S. foreign policy which were based on a perception that the United States and the Soviet Union will remain the preponderant powers in the foreseeable future. The policy also perceives that the conflicting nature of the opposed socio-economic systems will continue as will the political-military rivalry resulting. In addition, knowledgeable observers of the two systems have failed to discern any major trends toward convergence, so the situation is unlikely to change significantly throughout the 70s or 80s. The uneasy great power relationship requires that the United States retain its military strength at a level of "sufficiency," which is defined as the "maintenance of forces adequate to prevent us and our allies from being coerced" and "enough force to inflict

a level of damage on a potential aggressor sufficient to deter him from attacking."¹

The Administration views U.S. relations with its allies, particularly Western Europe, in terms of an increasing partnership. This policy recognizes the essential realities of a multipower world where the return to a "Fortress America" or isolationist concept is counterproductive. Although the United States continues to provide a nuclear guarantee to its allies, the defense of West European nations makes it necessary for them to assume more of the burden of their own defense.

The combination of finite U.S. power and increased interdependency with allies makes possible the third pillar of foreign policy which is active negotiations and reduced confrontation with adversaries. By engaging in strategic arms control negotiations with the Soviet Union (e.g., SALT I and II) and multilateral talks (e.g., MBFR force reductions in Europe), the United States promotes the formulation of new ground rules for cooperation. U.S. foreign policy has also broadened the negotiating process to bring the Peoples Republic of China (PRC) into the international arena. The gradual emergence of a nuclear technological base in the PRC was one of the stimulants to the diplomatic initiatives.

A relationship between RDT&E and global security planning can be discerned in terms of finite U.S. strength, partnership, and negotiation. The strength component of the rubric is concerned with not only the quantitative measures of military power between the United States and the USSR, but also the relative technological strength of both countries. The Soviet Union made dramatic progress during the past decade not only in the application of science and technology to the strengthening of its military forces, but also in the fields of space flight and commercial aviation. The fields are clearly related, and other areas of domestic progress are

¹ Richard M. Nixon, "U.S. Foreign Policy for the 1970s: Shaping a Durable Peace," Report to the Congress (3 May 1973).

logically derived from a wide spectrum of military technology. The USSR does not differentiate between civil and military technologies, accepts R&D inputs from any source (both national and international) and treats R&D as an essential element in the achievement of national policy. This effort has resulted in the perception of a technological threat to U.S. security, particularly in the strategic nuclear arena where Soviet progress has been concentrated. A significant portion of the strength element of U.S. foreign policy can be eroded by the strenuous efforts of the USSR to achieve technological supremacy in critical areas.

As noted above, national policy also emphasizes the need for partnership with European allies in a common effort to offset Soviet coercion and to strengthen prospects for a durable peace. This partnership has yet to achieve, however, a common strategic posture vis-a-vis the USSR in the political-economic area. In the military field, economies of scale in the development of common standards of design and production of weapons, which could benefit all the nations of the NATO alliance, have yet to be realized. The technological component of this difficulty tends to derive more from manifestations of national pride, economic concerns, and reluctance to forego the possibility of future technological breakthroughs than to sound military judgments. This problem is exemplified by weapon dissimilarities which sometimes defy the use of a common tactical doctrine with which to deploy forces. In addition, the added burden of multiple logistics and support operations in the event of hostilities encourages Soviet doubts on the viability of the alliance. U.S. leadership in bringing about a more effective technological and tactical coupling between nations of the Western alliance is still urgently needed if the partnership, burden sharing, combined planning, and interdependence aspects of national security policies are to be realized.

The national security aspects of RDT&E in a partnership role can be clearly identified in the military component of strategy. West European nations, collectively, spend about \$3 billion per year on research and development in nonstrategic weapons. Additional amounts are expended by

the British and French on strategic nuclear forces. Duplication of effort to at least the \$1 billion level, and possibly \$2 billion, has been disclosed by U.S. planners, and a much larger sum could probably be freed for other uses if force and materiel standardization and integration problems were overcome. However, continuing efforts to formulate acceptable technological agreements on a bilateral, multilateral, or regional basis can be expected as the economic advantages of interdependence become more obvious to nations of the Western world.

In the field of negotiations, RDT&E, as previously, will continue to play a major role in obtaining agreements with the Soviet Union and other nations respecting arms limitations and control. Of primary importance are the political-military agreements reached in SALT respecting nuclear weapons and their defenses. Technology was the essential ingredient which permitted the United States to accept asymmetry in numbers and size of ICBM silos, and the number of SLBMs allowed under the SALT interim agreement. The role of RDT&E in negotiations was established as being of importance to that of force size, and consequently it became an important factor in reaching accord on arms control. This role will be even more important as new critical technologies emerge, such as lasers, that may tip the scales of technological supremacy.

One of the least understood consequences of the "era of negotiations" has been the gradual realization that the United States has finite limits to its power and now requires substantial "shoring up" of its own internal capacities. The United States now must prepare for long-term negotiations rather than just confrontation with its adversaries in furtherance of its overriding aim, the prevention of general nuclear war. Such negotiations should be based on an effective and coherent national strategy developed by proper research and study. RDT&E will play an important role in the development of this strategy.

From the nonmilitary viewpoint, the commercial and economic interests of the United States in selling technology abroad result in the consideration

of both ally and adversary as a trading partner. This interest ranges from the direct sale of high-technology products to members of the Western alliance, to the third world, and to the USSR and PRC. Much concern has been expressed, however, in the sale of high-technology items to adversaries, since these items are related to commercial jet aircraft, electronics equipment, including computers, instrumentation, machinery, and manufacturing plants. The commercial suppliers are also very often DOD contractors; balance-of-trade considerations and the easing of tension are the generally expressed reasons for continuing this practice although many see the activity as dangerously impairing the U.S. technological lead. However, the United States is a major trading nation and, as such, must weight its economic interests continuously with other elements of the national strategy to achieve a balanced position vis-a-vis security planning. Other items of existing and evolving national policy which have a direct impact upon security planning include such considerations as interdependence, resource utilization (financial, manpower, minerals, etc.) and the human ecology. The interdependence theme will reach new levels of importance during the late 1970s, and place renewed emphasis upon cooperative force planning, weapon and equipment production, and R&D with major allies. This trend is driven by problems of world inflation and the need to develop an integrated supporting structure (common force planning, R&D requirements, common weapons systems, tactics, logistics, raw material use, etc.) for the United States, allied forces, and selected members of the third world.

In summary, basic changes in strategic planning with major implications for R&D planning are being driven by rapid advances in technology; shift of public and Congressional attention and priorities to domestic problems like inflation, unemployment and environmental pollution; shortages of funds for the military aspects of national security because of budgetary cuts, inflation, and excessive manpower costs; increased international turbulence because of widespread mass hunger and even of starvation and other economic stresses such as energy and raw materials shortages. Given (1) the changing strategic nuclear equation, (2) domestic pressures in the United States and Western Europe for reduced defense

budgets, (3) scarcity of manpower and materials, (4) the deteriorating southern flank of NATO, and (5) increased tension in the Middle East, a fresh approach to strategy formulation and RDT&E and force planning appears mandatory if alliance cohesion is to be maintained in the new international environment. The new American "strategic nuclear options strategy" lends further urgency to studying NATO strategy and nuclear policy as it affects the credibility of the American nuclear guarantee to Western Europe in the age of strategic parity.

An upgrading of the NATO-European problems is required with a concentrated attack on (1) new concepts and approaches for solving NATO economic and political problems through cooperation and burden sharing on weapon systems development; (2) exploration of new manpower approaches such as the "Citizen's Army" or territorial force concept; (3) an updated nuclear policy toward France and England; (4) the development of national consensus in the United States and with European partners on tactical nuclear doctrine; and (5) a better-understood public rationale for the new strategic and tactical nuclear force options related to the defense of Europe. A fundamental reexamination of our defense strategy is needed, to meet the goal of preventing a general nuclear war through U.S.-Soviet negotiations and agreements.

An era of increasingly scarce defense resources was heralded by instituting the all-volunteer force and reinforced by budgetary reductions and inflation, the oil embargo, and other mineral scarcities. These factors now bear heavily upon the program decisions made during the defense planning process, and very little alleviation is expected during either the short or the long term.

From the above considerations of national security interests and the defense role, a set of defense goals and guidelines have been developed to guide the development of U.S. policy and the world environment. In addition, a set of national security goals and guidelines have been developed to guide the development of U.S. policy and the world environment, based on a common understanding (intelligence, information,

and perceptions); military strength (deterrence, containment, and war-fighting); international alliances (cooperation and interdependence); negotiations (arms control and force reductions); and efficiency (resource development and utilization). Table 1 lists the principal defense and RDT&E guidelines which help ensure attainment of these five major defense goals. The political, economic and military factors pertinent to the derivation of these defense goals and guidelines are discussed in detail in Appendix A.

Table 1

GOALS AND GUIDELINES FOR DEFENSE PLANNING

I NATIONAL SECURITY GUIDELINES

- Understanding (Intelligence, Information and Perceptions)
- Military Strength (Deterrence, Containment and Warfighting)
- International Alliances (Cooperation and Interdependence)
- Negotiations (Arms Control and Force Reductions)
- Efficiency (Resource Development and Utilization)

1.1 DEFENSE GUIDELINES

Understanding

- Integrated political, military and economic perspective for national regional global strategy and policy
- Intelligence to understand current and developing threat
- Scientific and technical assessment to determine technological posture and significance of adversaries and allies R&D and identify opportunities derived from U.S. national technological achievements
- Public support of security goals as directly related to national survival and viability
- Operational test and evaluation to understand limitations and vulnerabilities of U.S. weapon systems

Military Strength

- Strategic nuclear force parity with or superiority over USSR
- Superiority in nuclear and associated technologies
- Rapid war termination in conjunction with strategic and theater nuclear responses
- Sufficient forward deployed forces to deter and contain regional aggression
 - blitzkrieg detainment
 - interdiction of reinforcements and logistics
 - enhance penetrability and survivability of tactical air forces
 - improve capability to provide interdiction and close air support
- Dual capable, highly mobile, adaptable forces--integration of nuclear and nonnuclear forces
- CONUS-based forces capable of rapid reinforcement of forward forces or rapid containment of regional aggression or intimidation

Table 1 (Continued)

- strategic lift capability
- highly efficient firepower and command control
- One and a half warfighting capability
- inter-theater lift capability
- European theater dominant in structuring force with secondary emphasis on Middle East, East Asia and the Pacific
- Integration of tactical-strategic command, control communications system
- Capabilities to control essential sea lines of communications

International Alliances

- Maintain the effectiveness of mutual defense alliances
- Joint allied defense planning and integration of allied resources
- cooperative weapons procurement programs
- cooperative RDT&E programs
- cooperative standardization program
- Security assistance with practical weapons and indigenous production
- balanced force capability in friendly developing nations
- Stimulate formation of territorial forces in Europe
- Linkage of British/French and U.S. nuclear capability

Negotiations

- Defense posture to promote further arms control and force reduction agreements
- Technology development to provide arms detection methods to stimulate further agreements
- Technology development as aid to negotiation

Efficiency

- Minimize resource requirements and impact upon ecology and economy
- Improved management techniques to enhance program/resource efficiency and provide reduced acquisition costs

Table 1 (Continued)

- continue and expand design-to-cost program
- pursue further prototyping and "fly before buy" programs
- program selectivity based on effectiveness and "return on investment" concept
- exploit competitive procurement techniques
- professional program management
- Integrated planning with appropriate civil sectors of the defense supporting economy

IV DEFENSE PLANNING SYSTEMS

Until the late 1960s, the RDT&E component of the defense program was derived almost exclusively from force planning and was relegated to a supporting role in the formulation of defense planning. Radical changes, however, occasioned by Soviet advances in both force strength and technology and a diminishing defense budget require technology to be accorded a major role in the formulation of defense plans.

A. Force Planning

In the construction of the U.S. future force posture, guidance has been provided in the form of a military planning strategy which has been derived from recent enunciations of foreign policy. Termed the Strategy of Realistic Deterrence, it emphasizes the rubrics of strength, partnership, and negotiation as the fundamental drive to current force planning.

The three major planning elements of the strategy are Net Assessment, Total Force Planning, and Long Range Planning.

1. Net Assessment

This term is used to describe an analytical activity of DOD which compares the military, technological, political, and economic factors impeding or enhancing the achievement of national security objectives. Basically, net assessment is the comparative analysis of the capabilities and weaknesses of potential adversaries with the capabilities and weaknesses of the United States and its allies. Net assessment takes into account the imperatives and constraints of the strategic, political, fiscal, and manpower realities. However, it is most concerned with the military threat posed by adversaries at all levels of conflict. In keeping with the

strategy, net assessment is designed to appropriately account for the varying impacts of the four realities concerned with strategy, politics, money, and manpower.¹

- The strategic reality is concerned with the threat posed by the Soviet Union to the United States and its allies. This threat includes the entire range of Soviet military and paramilitary efforts, from Soviet assistance to the Third World to the Soviet strategic nuclear challenge to U.S. deterrent forces.
- The political reality is concerned with both international and internal political factors which affect national security policy. International factors include: (1) the political and psychological effects of increasing Soviet military capabilities and presence throughout the world; (2) concerns of U.S. allies that the United States maintain substantial forward deployed forces; (3) the possible impact of SALT agreements on U.S. military forces; and (4) possible confrontation with the USSR in the Middle East. Internal factors include: (1) the difficulty of maintaining broad domestic public support for national security efforts; and (2) Congressional opposition to policies, specifically Congressional desires to withdraw forward deployed forces.
- The fiscal reality concerns the urgent need to commit greater resources to domestic problems at a time of rising military costs. While defense costs have been declining in real terms, the defense budget reflects increases resulting from inflation, force modernization and manpower costs.
- The manpower reality is concerned with the pressures for smaller active armed forces and the recruitment and motivation problems of an all-volunteer service.²

2. Total Force Planning

A major thrust of the planning strategy deals with the development of a force posture which takes into account all U.S. forces, including

¹ DOD Report FY1973.

² "Integrated Global Force Posture Analysis," SSC-TN-2240-30, SRI/Strategic Studies Center (January 1974).

national guard and reserves, and the forces of allies. Force planning encompasses the four levels of potential conflict, i.e., strategic nuclear forces, theater nuclear forces, theater conventional forces and sub-theater localized forces. The highest level of conflict is the burden of the United States alone, but the three other levels require the planning of force postures and related activities in consultation with allies. To this end, the following guidelines are in current use:¹

- In deterring strategic nuclear war, primary reliance will be placed on U.S. strategic forces.
- In deterring theater nuclear war, the United States also has primary responsibility, but those allies who have nuclear capabilities share in this responsibility.
- In deterring theater conventional war, U.S. and allied forces share responsibility.
- In deterring subtheater or localized war, the country which is threatened has primary responsibility particularly for providing manpower, but when U.S. interests or obligations are at stake the United States will provide help as appropriate.

Further guidance has been formulated with respect to the categories of force planning to be considered in the development of plans; these are:²

- Combined force planning assumes the integration of U.S. and allied forces (e.g., NATO and Korea) and involves close consultation with allies.
- Complementary force planning assumes U.S. military obligations to help in the defense of an ally, but does not involve prepositioned U.S. ground forces during peacetime (e.g., Japan); it also involves close allied consultation.
- Supplementary force planning assumes an American role in aiding allies' defense capabilities, basically through appropriate security assistance (e.g., Indonesia, Israel).

¹ DOD Report FY1973, p. 23.

² Ibid., pp. 63, 64.

- Unilateral force planning involves contingencies in areas where U.S. interests are at stake; only U.S. forces would be involved and allied help would not be expected.

Hence, the "partnership" aspect of foreign policy is strongly emphasized in the planning of the future U.S. force posture. A notable exception is of course the development and maintenance of strategic nuclear forces where "technological partnership" is constrained by both U.S. law and international treaties.

3. Long-Range Defense Planning

Long-range defense planning is the third major element of the current planning procedure drawing guidance directly from net assessment and total force planning. RDT&E planning is an integral part of the long-range planning process and tends to be one of the more important activities of the process.

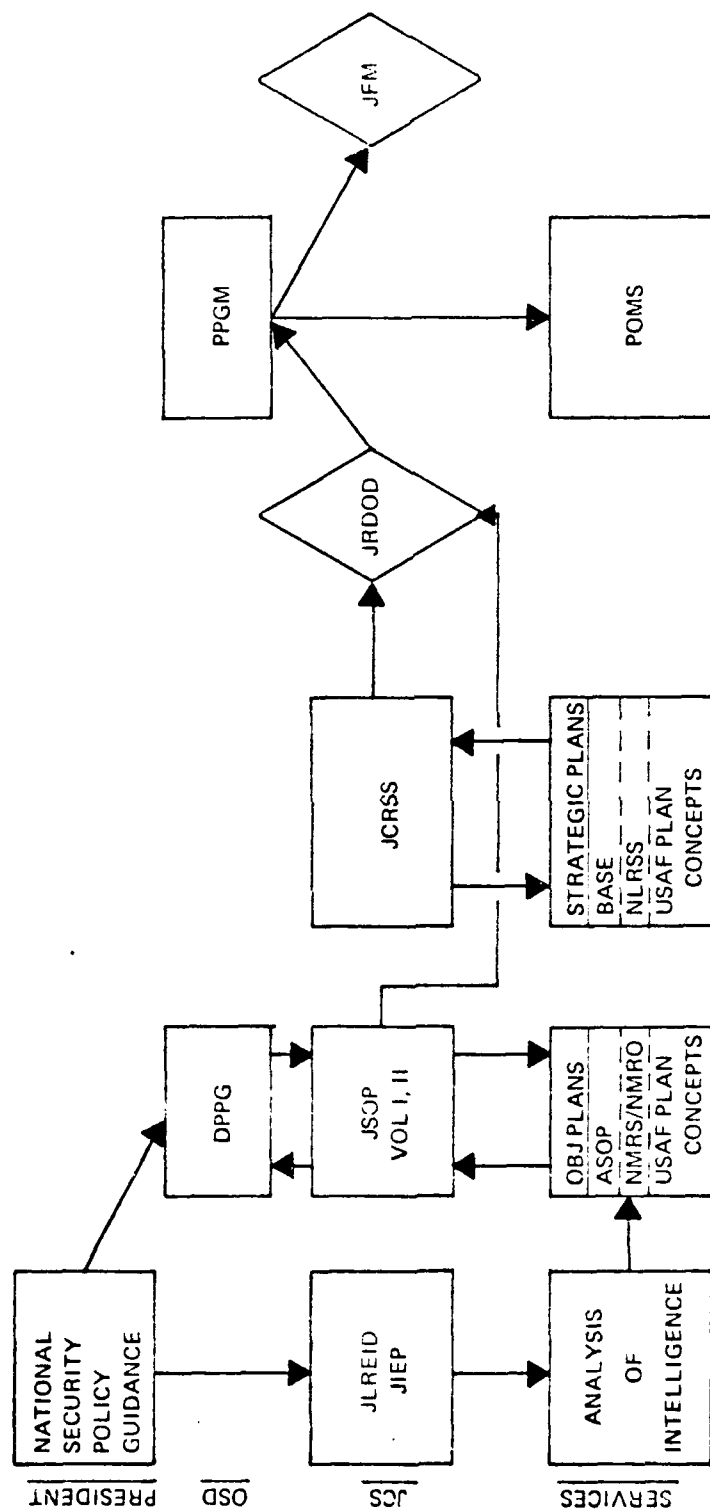
B. RDT&E Planning


In scrutinizing the existing defense RDT&E planning process it is apparent that the requirements formulation systems of the JCS and Services are the major drive to R&D program development. Encompassing both threat- and nonthreat-dependent considerations, the process is conceived as the essential communications bridge between the Services and the various categories of performers. Official needs are also expressed at a higher level of aggregation by the Director, Defense Research and Engineering in communications with the Congress and other elements of the Executive. In addition, there are a number of informal channels, such as professional and industrial symposia and association meetings, used in communicating varying levels of detail to differing audiences. Finally, there are broad expressions of scientific and technological need which emanate from the highest levels of government and are oriented towards the American public, allies, and the world in general.

Ordinarily the research and development process does not differentiate between the response to an observed threat and the response to an anticipated threat. The amount of time involved in the development of new systems might be rationalized to imply that emphasis is on anticipatory needs. However, this is not the case for many weapons systems that still take from 10 to 15 years to reach fruition from concept formulation. The quality and number of weapons systems procured are determined by the estimate of the threat over time and the technological capability of R&D laboratories both public and private. Because of the cloak of secrecy surrounding all Soviet military research and development, the United States must guard continuously against technological surprise. To this end, heavy emphasis in policy statements is placed upon the maintenance of a broad technological base with which to guard against adversary breakthroughs in key technological areas.

The Department of Defense (DOD) process for formulating RDT&E requirements can be stimulated by several means, the principal ones being responses to known or anticipated military threats. Secondary stimulants to the development of requirements are breakthroughs which occur in the technological base portion of the RDT&E program, and result in opportunities to enhance military operational capabilities. Requirements themselves are expressions of defense needs that are translated into detailed specifications; these are then used as the basis for planning the development of weapons systems, equipments, or components, or to undertake research on various segments of the scientific spectrum.

The DOD Planning, Programming and Budgeting System (PPBS) provides a starting point for describing the current system for formulating RDT&E requirements. See also Appendix B: The RDT&E Planning System. An illustration of the abbreviated cycle is shown in Figure 2 displaying the major relationships between the DOD planning cycle and the development of the Joint Research and Development Objective Document (JRDOD). This annually updated document is of importance in the preparation of Service requirements, since it responds to the dynamics of national security policy,



LEGEND:  Documents which provide R&D objectives.

ASOP -- Army Strategic Objectives Plan

BASE – Basic Army Strategic Estimate

DPPG – Defense Policy and Planning Guidance Memorandum

JFM - Joint Force Memorandum

JIEP – Joint Intelligence Estimate for Planning

JLRLR10 Joint Long Range Estimative Intelligence

Document

JRDOD -- Joint Research and Development Objective Document

JSOP – Joint Strategic Objectives Plan

NLRSS – Navy Long Range Strategic Study

NMRS – Navy Mid Range Study

NMRO -- Navy Mid Range Objectives

POM – Program Objectives Memorandum

PPGM -- Planning and Programming Guidance Memorandum

Figure 2 FORTULATION OF R&D OBJECTIVES IN THE PPBS CYCLE

strategic planning, and intelligence estimates. Each of the Services has a family of plans which are both inputs to and derivatives of the PPES process, and which also result in the establishment of RDT&E requirements. Military Department requirements are expressed in a number of documents which correspond to various levels of RDT&E activity, and in general, each Service divides its requirements between research and operational capability needs.

A comprehensive discussion of the requirements formulation process is contained in Appendix C (Defense RDT&E Policies) of this report. It is sufficient to note here that planning with respect to program initiation and product development and testing must be responsive to the dynamics of both domestic and international affairs. These plans primarily impact upon the need to enhance on a priority basis one or more aspects of the U.S. military posture. The requirements that stem from these plans, however, are highly susceptible to modification or cancellation. This is particularly true when major weapons systems are proceeding through the development cycle since such diverse reasons as changes in threat, failure to achieve specifications, cost overruns, international agreements and treaties, and domestic legislation are all potential conduits for program termination.

The current defense RDT&E program is aimed primarily at the alleviation of force posture deficiencies that become apparent when U.S. forces are compared with the current and projected military capabilities of the USSR. Modernization is facilitated by either completely replacing obsolete or marginal weapons or improving the performance of existing systems through the upgrading of subsystems or components. Both approaches are in current use although the present trend of fielding new systems portends a new cycle of replacing outmoded systems.

Three of the more important drives to RDT&E planning are net technical assessment, threat assessment, and technological progress. Only net technical assessment and its implications for future R&D planning will be discussed in this section of the report.

Net technical assessment (NTA) is a form of net assessment. Generically, a net assessment is an analytic judgment of the outcome of an interaction of opposing elements in a defined environment. The judgment can be a conclusion as to the effectiveness of any of the elements (actions, weapon systems, policies). It can state the implications that could flow from the decision to implement a policy or use a weapon system. The environment must be defined specifically using actual, estimated, or assumed factors. The elements being interacted can be defined in a similar manner. But crucial to a net assessment is the adversary concept. The inputs specifying the elements to be tested should be from a source different than that specifying the opposition. In instances where U.S. weapon systems, tactics, strategies, or foreign policies are to be tested, the intelligence unit should develop the opposing force or elements. This must be done without prior guidelines or limits being set by the policy side other than the time period, environment, and perhaps the type of event in which the test occurs.

The primary role of NTA as used by the Department of Defense is to develop inputs to assist DDR&E in determining the most effective R&D programs. A major element in the process is to compare what is known of Soviet and other nations' activities in scientific research and weapons development to the corresponding activities in the United States. Secondly, the NTA function is to test ideas, concepts, and parametric systems to discern advantages and disadvantages of suggested U.S. approaches. There are four general categories to NTA. Essential to each is the input of intelligence directly from the producing agency (or agencies). It is the adversary concept, with inputs coming from the U.S. side and from the other country (or countries) with data being developed by separate agencies without prior review or editing of the data by an intervening authority, that sets "net assessment" aside from other forms of analysis.

The first type of assessment used by NTA is a comparative analysis with a net summation of the total thrust of U.S. versus Soviet

(or other country) technology to point up apparent similarities, asymmetries, areas of emphasis, and time phasing on each side.

The second type of assessment used by NTA is side-by-side weapons comparison. In this type, a Blue weapon system, new or projected, is compared with the closest similar type Red weapon system. It is not an offense-defense comparison, but rather one of exploring the characteristics of each system relative to a similar combat mission.

The third type of assessment used by NTA is one-on-one weapon system testing--offense versus defense. In this type a U.S. system is tested against a single enemy opposing weapon system. Or it can be used to test against several systems, but still only one at a time. The objective is to develop basic data on the comparative capability of a U.S. weapon system to carry out its mission when opposed by a single opponent.

The fourth type of assessment used by NTA could be force unit testing (offense versus defense). In this type, a U.S. system in its smallest tactical unit formation would be tested against some mix of adversary weapons in an appropriate enemy tactical area, and in the same space of time. For example, a B-1 bomber would be placed in a bombing mission in which it might be associated with other bombers for defense or roll-back missions. It would be tested against all systems the adversary could bring to bear during the time period the B-1 would be in the area.

C. Defense Planning Relationships

In developing a further understanding of defense planning, a review of the U.S. national security strategy is in order to understand the planning relationship. The word strategy is accorded several levels of meaning, with each being considered correct usage when introduced in an appropriate context. The term national strategy, which encompasses the planning and implementation of events to achieve national purposes, is generally defined as:

The science and art of employing the political, economic, psychological, and military forces of a nation or group of nations to afford the maximum support to adopted policies in peace and war.¹

This broad description embraces the four principal forces of government which must be harnessed together in a complementary relationship to ensure the employment of a cohesive national strategy. The political, economic, psychological, and military substrategies must be derived from grand strategy, and dynamically adjusted over time in form, emphasis, and application in response to global interactions. Defense RDT&E is an essential adjunct to military mission and force planning; it supports economic, political, and psychological substrategies planning, and on occasions assumes a semiautonomous role in the field of national security planning.

In considering technology as a component of the substrategies noted above, it must be first recognized that some 42 percent of the total R&D funds expended by the United States are privately financed and managed, so they are not altogether amenable to grand strategy planning. This component of R&D is generally orchestrated into national strategy as technological advances occur rather than by design as in the case of most U.S. Government R&D. U.S. Government expenditures amount to about \$17.5 billion. Approximately \$8 billion of this, or under 50 percent of all R&D, is managed by the Department of Defense.

Defense RDT&E is by definition primarily concerned with the longer term enhancement of national defense. However, secondary political, psychological, and economic issues which are not directly related to questions of force modernization must also be recognized in devising an overall RDT&E strategy. Thus, the integration of RDT&E into the national planning process can be considered in terms of the relationship of RDT&E to two levels of planning. These are:

¹ Joint Chiefs of Staff, "Department of Defense Dictionary of Military and Associated Terms," Washington, D.C.: Government Printing Office (3 January 1972) p. 202.

- National Security Planning, which responds to the dynamics of political, military, psychological, and economic interactions among and between the United States, allies and adversaries, and third countries, in response to the various multipolar forces at work in the world.
- Department of Defense planning, which responds to specific outputs from national security planning by the formulation of strategy to support overall military force needs.

Accordingly, a defense RDT&E planning strategy can be defined as:

- A strategy derived from and furthering grand strategy and, more particularly, directly supporting the modernization of military forces and the national security purposes of those forces.
- A strategy which couples defense RDT&E to the achievement of both national security goals and to those political, economic, and psychological aspects of grand strategy that can be served by defense technology.
- A technological strategy to support national strategic planning by the formulation of RDT&E goals and objectives, and the planning mechanisms with which to achieve these goals and objectives.

The three definitions given above are intended as variations in interpretation and levels of detail and not as alternatives. Together they constitute an overview of RDT&E strategy and encompass the key considerations which contribute to the formulation of a planning system and strategic parameters.

V STRATEGY PARAMETERS AND TOTAL R&D PLANNING

Technology plays a readily discernible role, is a key factor in the development of the defense posture, and can be orchestrated into a major element of national security strategy. As discussed above, substrategies are served by technology in: arms control and technology transfer negotiations (political); industrial productivity and trade (economic); national and international prestige (psychological); and weapons and force modernization (military). Technology enhances and supports both the domestic and international elements of grand strategy and is perceived as a major factor in stimulating both elements.

The parameters of an RDT&E strategy can be expressed as: (1) defense and R&D goals derived from expressions of national security strategy, (2) research and development objectives based upon an assessment of goals and the constraining factors which may inhibit the attainment of objectives, and (3) the development of plans to achieve objectives. The relationships between these parameters are displayed graphically in Figure 3.

A. Defense and RDT&E Goals

Expressions of national defense and RDT&E goals can be derived from Presidential policy statements, JCS documents, statements of the Secretary of Defense and Director, Defense Research and Engineering, and from the Services.

Chapter III of this report identified a set of defense goals and guidelines and translated these into a series of military force and R&D guidelines. From the viewpoint of methodological development, an initial synthesis of these expressions and statements of goals and guidelines should be completed and, where applicable, military force guidelines must also be interpreted to permit the expression of derivative R&D goals. The development of RDT&E goals

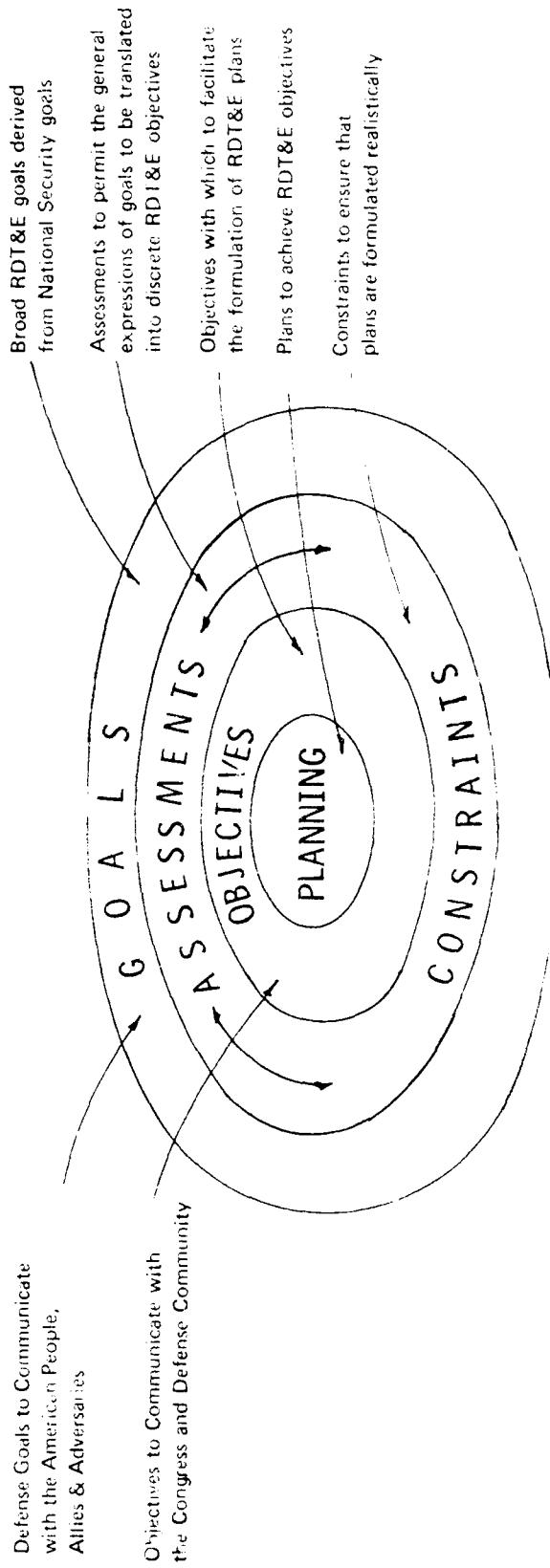


Figure 3 RDT&E PARAMETERS AND PLANNING FACTORS

is perceived as the major drive to the development of parameters with which to develop RDT&E strategy.

Goals for defense RDT&E drawn from national security goals should also be compatible with the strategy for the achievement of both sets of goals. However, in the development of RDT&E strategy and the structuring of R&D goals it must be recognized that a full research and development cycle on many systems may take a decade or more to complete. Further, the RDT&E process is by definition an organized effort to advance or capture technology in the face of uncertainty. These two factors suggest that RDT&E goals designed to serve a major element of national policy are conceived with a high-risk content if emphasis is placed on the research end of the R&D system. Further, when goals formulated in response to the dictates of national policy require the identification of the critical links of U.S. national security strategy which must be strengthened at specific points in time if militarily or politically meaningful results are to be obtained.

As shown in Table 1, a critical defense guideline for defense R&D is the development and maintenance of a comprehensive understanding of both the United States, its allies, and its adversaries. The principal implications for R&D are technology assessments and developments to assist in the understanding of adversary efforts and to identify opportunities for exploitation. A major problem requiring resolution is the determination of how best to harness all U.S. elements of the R&D community into the defense RDT&E program. This can only be accomplished by the development of mechanisms to foster further cooperation between all elements of government and industry, and the development of an improved information system to facilitate the flow of technological data. The development of RDT&E goals that respond to an understanding of national security guidelines also requires consideration of political, psychological, and economic factors in addition to military concerns.

Military strength within the context of national strategy emphasizes the need for RDT&E support at four levels of conflict, i.e., strategic nuclear, theater nuclear, theater conventional, and subtheater nuclear.

forces. The current strategy calls for force sufficiency or parity in terms of the quantity of strategic nuclear weapons required, but technological superiority is identified as an RDT&E goal to maintain a quality gap vis-a-vis the USSR. The U.S. developmental effort on the Trident missile/boat combination and the B-1 strategic bomber is expected to qualitatively improve U.S. strategic offensive systems; however, their introduction into service in the late 70s or early 80s may not counterbalance Soviet numerical and throw-weight advantages because of progress in USSR technology. This suggests that additional RDT&E bargaining chips may be needed to support the U.S. negotiation position of both sufficiency and parity of strategic forces.

Alternative RDT&E goals must thus be evaluated in response to the initial SALT II outcomes if a politically responsive program is to be devised which matches the U.S. security needs of the future. Similar goal-oriented consideration must be given the U.S. bargaining position on the Limitation of Anti-Ballistic Missile Systems Treaty which provides for reviews at five-year intervals. The review of these agreements and such others as may be anticipated in support of the nuclear arms control field must be reflected in RDT&E goals.

The RDT&E goals derived from general purpose force needs must stimulate a broad program aimed at the substitution of technology to offset, whenever possible, manpower limitations or imbalances in combat capabilities. R&D to promote the fielding of dual-purpose (tactical nuclear and conventional) forces is a high-priority need which requires immediate attention. The command, control and communications system which links theater forces, especially tactical nuclear, to the strategic nuclear deterrent must be strengthened by appropriate R&D efforts. The development of highly mobile, adaptable, small-unit forces requires emphasis to provide for effective war-fighting capabilities in the event of tactical nuclear operations. Improved surveillance and target acquisition are also high-priority items.

Of major importance to the United States is the state of its political-military linkage with the NATO nations of Europe; this linkage has been the cornerstone of U.S. national security policy as illustrated by U.S. foreign

policy and defense guidelines. Recent economic problems must be assessed to determine their impact upon the alliance. One possibility is that a more compelling case can be made for interdependence in the R&D field. The nations of Western Europe are a major source of scientific and technological advancement and as such are capable of making major RDT&E contributions to the common security. This situation suggests that selected research and development efforts supporting levels of conflict at or below the strategic nuclear threshold could be performed jointly with our NATO allies. Interdependence could thus be strengthened by the establishment of viable alliances in the science and technology field. This RDT&E goal, if appropriately juxtaposed with other political objectives, could serve to strengthen the deterrent posture of NATO.

Efficiency of effort will tend to be even further emphasized in the RDT&E program as the "age of shortages" gathers momentum. The R&D goals derived from this defense guideline and national security strategy will impose severe restrictions on the number of development efforts that can be brought to fruition. Further shortages of military manpower, minerals, and funds must be anticipated; these events will place a premium on the development of management efficiency, joint service R&D programs, and integrated R&D planning with appropriate sectors of the national and international communities.

B. Assessments and Constraints

Defense RDT&E strategy parameters have been discussed previously in terms of goals derived from higher order strategy and the translation of these goals into R&D terminology. The purpose of this section of the report is to consider the assessments that must be made to translate broad defense and RDT&E goals into objectives that can be used to communicate program information to the involved community. In addition, this section will identify the principal constraining factors which inhibit or control the implementation of R&D efforts.

1. Net RDT&E Assessment

The term net RDT&E assessment has been adopted to emphasize the need for a wider ranging approach to the establishment of R&D objectives. The present system of net technical assessment, threat assessment, and technology forecasting is severely limited in scope. It fails to appropriately introduce the many factors which must be considered in the formulation of the RDT&E program. These factors, among others, include the further scrutiny of political-economic-strategic considerations and the essential characteristics of the R&D community to further the development of an effective program. Net RDT&E assessment is comprised of four elements; these are:

- Mission Assessment. Assessment and comparative analysis of U.S., allied, and adversary mission capabilities.
- Technological Assessment. Assessment and comparative analysis of U.S., allied, and adversary technological capability.
- Resource Assessment. Assessment and comparative analysis of U.S., allied, and adversary manpower, facility, materiel, and fiscal capability.
- Organizational Assessment. Assessment of organizational capability to plan, program, and implement RDT&E efforts.

a. Mission Assessment

The trend toward "missionizing" the R&D program by the Department of Defense has been reinforced in the Congress by appropriate legislation to permit an improved understanding of the overall program. This trend has been assimilated in the proposed planning methodology outlined in this report, and also expanded to further support the development of R&D objectives. The R&D missions, which are identified in Figure 4 together with the desired assessments, are: strategic offensive; strategic defensive; command, control, and communications; tactical land warfare; tactical air warfare; ocean control; mobility; intelligence; special operations; and administration.

MISSION

- STRATEGIC OFFENSIVE
- STRATEGIC DEFENSE
- COMMAND, CONTROL, COMMUNICATIONS
- TACTICAL LAND WARFARE
- TACTICAL AIR WARFARE
- OCEAN CONTROL
- MOBILITY
- INTELLIGENCE -SURVEILLANCE
- SPECIAL OPERATIONS
- ADMINISTRATION

ASSESSMENT INGREDIENTS

1. MISSION CHARACTERISTICS
2. POLITICAL - STRATEGIC RELATIONSHIPS
3. CAPABILITY (U.S. AND ALLIED). WEAPONS, TACTICS LOGISTICS, MAINTENANCE, AND DEPLOYMENT ATTRIBUTES
4. ADVERSARY MISSION AND MISSION DENIAL CAPABILITY
5. MAJOR INTERFACES WITH OTHER MISSIONS
6. MISSION CONSTRAINTS -- TREATY, LAW POLITICAL
7. ALTERNATIVES ANALYSIS
8. DEFICIENCY -- ADEQUACY ANALYSIS
9. TECHNOLOGICAL BASE IMPLICATIONS
10. MISSION OBJECTIVES DOCUMENTATION

Figure 4 MISSION ASSESSMENT

The ten assessment ingredients (see also Figure 4) have been devised to ensure that each R&D mission is thoroughly analyzed and documented with respect to the political, military and economic implications of program decisions. The assessment encompasses:

- A review of the mission's current and historical characteristics to preface the analysis.
- An investigation of the political-strategic relationship of the mission.
- A discussion of the current and projected capability of U.S. and allied forces to ascertain R&D needs.
- An analysis of adversary mission and mission denial capability including threat forecast, and lessons learned in recent conflict situations.
- A discussion of the interfaces with other missions to document complementarities and any overlapping capability.
- The identification of constraining factors including treaties, laws, and political sensitivities.
- An evaluation of the alternative approaches to fulfilling mission requirements.
- A statement of the deficiencies or adequacies of the mission related R&D effort.
- The enumeration of any technological base requirements.
- The development of an objectives statement encompassing a discussion of the above factors, and specifically identifying R&D objectives.

b. Technological Assessment

Technological assessment is conceived as a broad analysis of technology (within which net technical assessment is a single ingredient) which is designed to further the development of technological base objectives. Figure 5 identifies the technology/scientific areas of dominant defense interest; these are portrayed as thirteen activities undertaken in the 6.1 (research), 6.2 (exploratory development) and 6.3A (selected portion of advanced development) categories of the defense R&D program. The assessment ingredients are:

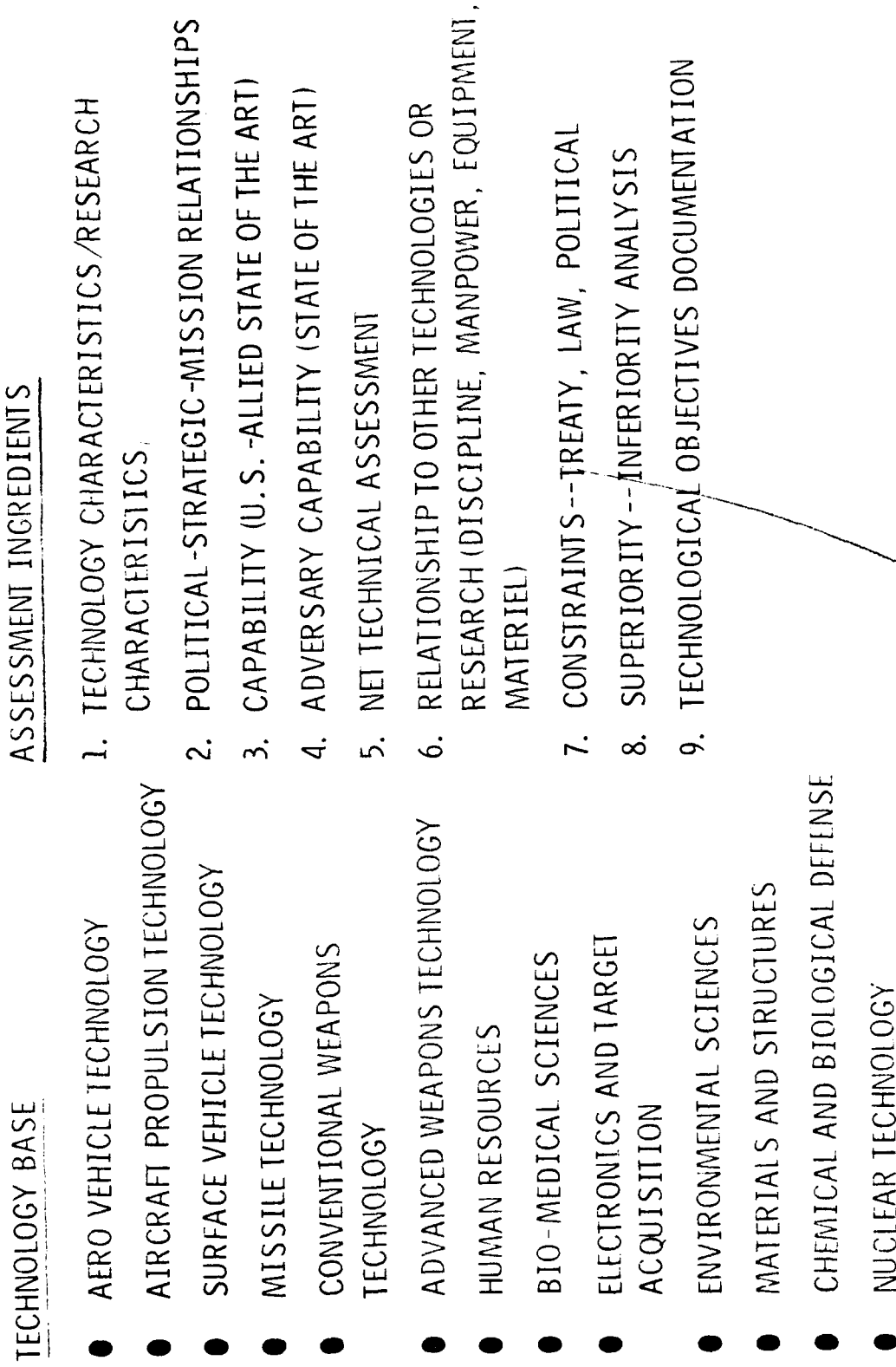


Figure 5 TECHNOLOGICAL ASSESSMENT

- A review of the technological/scientific characteristics of each field including information on current and historical efforts.
- An analysis of the technology's relationship to defense missions and any political-strategic consideration.
- A statement of the U.S. and allied "state of the art" capability.
- An analysis of adversary "state of the art" capability.
- Net technical assessment in terms of technological base implications.
- An evaluation of the relationship of the technological effort to companion or related fields in terms of disciplines, manpower, equipment and materiel.
- An evaluation of any constraints on the furthering of research including treaty, law, and political sensitivities.
- An examination of the technological effort underway in all appropriate sectors of the national and international arena to expose technological opportunities.
- The development of objectives statements for all fourteen fields which encompass a discussion of the above factors and specifically identify technological base objectives.

c. Resource Assessment

An overriding problem for the nation, which is unlikely to be alleviated in the foreseeable future, is the need for resource conservation. This concern will continue to impact the defense community's effort to upgrade the force posture and be reflected in R&D financial, manpower, facility, and materiel shortages. Resource assessment is thus considered an essential element of the proposed process to derive R&D objectives. Figure 6 indicates the primary areas of concern together with an outline of the assessment ingredients; these are:

- A review of the historical trends and current situation respecting the four resources.
- An analysis of the political, economic, and strategic relationships to future resource development.

RESOURCE

- MANPOWER
- FACILITY
- MATERIEL
- FINANCIAL

ASSESSMENT INGREDIENTS

1. RESOURCE CHARACTERISTICS
2. POLITICAL-ECONOMIC-STRATEGIC RELATIONSHIPS
3. RESOURCE AVAILABILITY (U.S. AND ALLIED)
4. RESOURCE AVAILABILITY (ADVERSARY)
5. MAJOR RELATIONSHIPS TO TECHNOLOGY AND MISSIONS
6. CONSTRAINTS--TREATY, LAW, POLITICAL
7. DEFICIENCY--SUFFICIENCY ANALYSIS
8. ALTERNATIVES ANALYSIS
9. SUPPORTING OBJECTIVES DOCUMENTATION

Figure 6 RESOURCE ASSESSMENT

- An evaluation of the resources available to the United States and allies.
- An evaluation of the resources available to adversaries.
- The identification of major relationships between resources and missions.
- The enumeration of extraneous constraining factors such as treaties, law, or political sensitivities.
- A projected deficiency-sufficiency analysis.
- The preparation of discrete objectives to further the development or improved utilization of R&D resources.

d. Organizational Assessment

The defense R&D community is led by a number of Defense organizations consisting of JCS, DDR&E, DARPA, DNA, and the elements of the three military services; these institutions constitute the official family providing leadership to the R&D program. Other elements of the family include AEC, other government R&D performers or managers, the defense and nondefense industry, and our allies. Periodic assessments of this community and reorganizations as necessary in government and revised approaches to other elements are essential to the continued vitality and efficiency of R&D efforts. Figure 7 indicates the organizational elements together with an outline of the assessment ingredients; these are:

- A review of the historical development of the various organizations together with a description of their primary functions (technology base/missions/other).
- An identification of the organizations' principal program relationship to other government defense and nondefense R&D elements, and the defense and nondefense industry.
- The enumeration of constraints such as directives, laws, or political considerations that limit the organizations' R&D role.

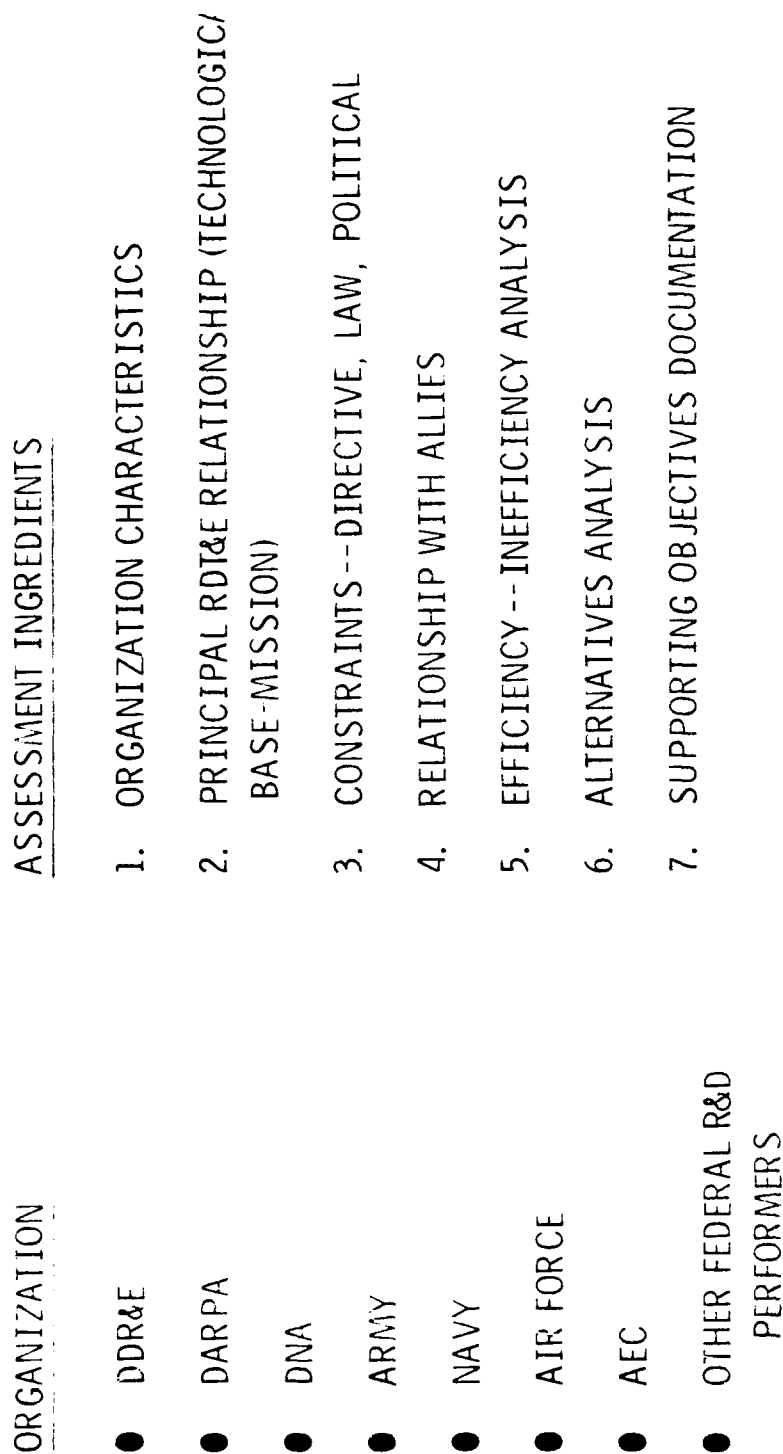


Figure 7 ORGANIZATIONAL ASSESSMENT

- An assessment of the organizations' relationship to allied performers in the cooperative R&D area.
- An evaluation of the projected role of each organization to discern the desirability for change.
- An analysis of organizational alternatives based on future mission, technological base, and resource assessments.
- The preparation of discrete objectives for each organization to further improve the administration and implementation of R&D programs and projects.

2. Constraining Factors

There are a number of constraining factors which must be taken into account in developing the R&D program. These constraints include: fiscal and budgetary; manpower; materials; domestic science policy; political considerations--allied and adversary; and treaties, international agreements, and U.S. legislation. These constraints have been introduced into the preceding section of the report under the Net RDT&E Assessment Section.

C. R&D Objectives

There appears to be no officially recognized or universally accepted definition of the term R&D objective in defense directives or other literature on the subject. Requirements documents are plentiful, however, and as discussed in Appendix B are the basic ordering documents for service R&D activities. They are narrowly conceived, contain very limited data on the overall mission or technology base needs, and do not embody in a supporting text the elements of assessment identified in the previous section of this report. These limitations in requirements documentation constrain their use to the specification of single systems or components. In addition, these vehicles are ineffective as communication devices to all but those directly involved in a single or limited aspect of the R&D program. The services translate selected requirements into a series of documents for general distribution to the defense industry, but these also lack the rationale for

communicating defense R&D needs in the larger framework of an overall mission or technological base objective. Resource and organizational objectives have no readily recognizable counterparts in the R&D system.

The term R&D objective, as used in this report, is construed to mean:

- An RDT&E objective, formulated within the Department of Defense, derived from national defense guidelines, which expresses the desired output to be derived from the investment of national RDT&E resources in a specific category in support of: defense missions, the technology base, and resource or organizational development. It is generated by an RDT&E net assessment and serves the PPBS system in planning, programming and budgeting RDT&E programs.

Objectives are further subdivided to include:

- A mission related RDT&E objective which provides goals to support the effective accomplishment of a defense mission. Ten objectives are shown in Table 2 together with a number of sub-objectives.
- A technology base related RDT&E objective which provides goals to develop, improve and/or manage the national technology base. Thirteen objectives are identified in Table 3.
- A resource related RDT&E objective which provides goals to develop, protect and/or maximize national assets committed to defense. Four objectives are identified in Table 3.
- An organizationally related RDT&E objective which provides goals to structure, manage and/or control organizations within the DOD.

A reading of these definitions reveals that an RDT&E objective is oriented to the policy level rather than the tactical requirements level. Objective formulation should focus on the armor/antiarmor problem, not the tactical requirement for an improved tank tread. The definition addresses "national RDT&E resources," not just those of the DOD, in an effort to capitalize on other U.S. RDT&E assets such as those of NASA, the AEC, the FAA, and the defense and nondefense industry. Nevertheless, the objectives are to be formulated within the DOD in support of defense activities.

Table 2

MISSION OBJECTIVES

<u>Mission Objective</u>	<u>Components</u> ¹	<u>Mission Objective</u>	<u>Components</u> ¹
1. STRATEGIC OFFENSE	1. Missile Systems 2. Strategic Aircraft 3. Defense Suppression 4. Electronic and Counter Electronic Warfare 5. New Systems and Concepts	4. TACTICAL AIR WARFARE	1. Air Superiority 2. Reconnaissance and Surveillance 3. Deep Strike/Interdiction 4. Defense Suppression 5. Close Air Support 6. Electronic and Counter Electronic Warfare 7. Navigation and Navigation Aids 8. New Systems and Concepts
2. STRATEGIC DEFENSE	1. Area 2. Site 3. Strategic Surveillance and Early Warning Systems 4. Electronic and Counter Electronic Warfare 5. New Systems and Concepts	5. TACTICAL LAND WARFARE	1. Infantry Operations 2. Tactical Nuclear Operations 3. Armor and Antiair Operations 4. Field Artillery Operations 5. Airborne and Airborne Operations 6. Engineer Operations 7. Air Defense Operations 8. Divergent Operations 9. Nuclear Operations 10. Chemical, Biological, Radiological Operations 11. Electronic and Counter Electronic Warfare 12. New Systems and Concepts
3. COMMAND, CONTROL AND COMMUNICATIONS	1. Command 2. Control 3. Communications 4. New Systems and Concepts		

¹ The component listing is not intended to be exclusive but demonstrative.

Table 2 (Cont'd)

Mission Objective	Components ¹	Mission Objective	Components
6. OCEAN CONTROL	<ol style="list-style-type: none"> 1. Ocean Surveillance 2. Fleet and Ocean Area Defense 3. Amphibious Operations 4. Surface Attack 5. Subsurface Attack 6. Electronic Warfare 7. Navigation and Navigation Aids 8. Oceanography 9. Mining and Mine Countermeasures 10. New Systems and Concepts 	9. SPECIAL OPERATIONS	<ol style="list-style-type: none"> 1. Internal Defense and Development 2. Internal Security and Public Order 3. Internal Defense and Development 4. Civil Affairs 5. Satellite, Space Operations and Astronautics 6. Environmental Systems 7. Support to Other Nations 8. Research, Development, Test and Evaluation 9. Asset Control and Economics 10. Guard and Reserve Forces 11. Security 12. Weather 13. Internal Security 14. New Systems and Concepts
7. MOBILITY	<ol style="list-style-type: none"> 1. Airlift 2. Surface 3. New Systems and Concepts 		
8. INTELLIGENCE	<ol style="list-style-type: none"> 1. Technology Assessment 2. Intelligence Systems 3. Cryptographic Security 4. Reconnaissance and Surveillance 5. New Systems and Concepts 	10. ADMINISTRATION	<ol style="list-style-type: none"> 1. Training 2. Weapons Effects 3. Technology Transfer 4. Logistics/Combat Service Support 5. New Systems and Concepts

¹ The component listing is not intended to be exclusive but demonstrative.

Table 3

SUPPORTING OBJECTIVES

<u>TECHNOLOGY BASE OBJECTIVES</u>	<u>RESOURCE OBJECTIVES</u>
1. Aero Vehicle Technology	1. Manpower
2. Aircraft Propulsion Technology	2. Facility
3. Surface Vehicle Technology	3. Materiel
4. Missile Technology	4. Financial
5. Conventional Weapons Technology	
6. Advanced Weapons Technology	
7. Human Resources	
8. Bio-Medical Sciences	
9. Electronics and Target Acquisition	
10. Environmental Sciences	
11. Materials and Structures	
12. Chemical and Biological Defense	
13. Nuclear Technology	

The resulting objectives would be used to communicate needs not only to the government and nongovernment defense community but also to those sectors of the national and international R&D community able to make contributions. Classified and unclassified versions would of course be necessary to protect the U.S. security interest. These formatted and documented objective statements, based on the realities of mission constraints imposed by law, treaty, or other considerations, would encourage and facilitate the transfer of technology among allies and between the DOD, other governmental agencies, and civilian sectors.

D. Total RDT&E Planning

The RDT&E planning process requires a major overhaul to tune the activity more closely to the evolution of U.S. national strategy, Soviet strategy, and the inevitable processes of an interdependent world. To this end an RDT&E planning system is proposed which is based upon comprehensive assessments of military missions, the technology base, and the resource and organizational realities. A derivative of the assessment processes are defense RDT&E objectives which can be communicated to the entire R&D community. These objectives, for example, would be used to stimulate the JCS and Services requirements formulation process and provide the needed additional guidance for the defense industries' R&D effort. The RDT&E planning method proposed is designed to serve as a direct complement to force planning.

The five major planning efforts stemming from the process are discussed below:

- Technological base planning is conducted by the many elements of the DOD family; however, each organizational unit develops and maintains its own documentation. The need exists for consolidated documentation, derived from assessments and showing the interrelationships among and between the plans that are developed to meet the thirteen technological base objectives previously discussed. The resulting planning effort would provide an important vehicle to improve program understanding and the communication of scientific and technical knowledge throughout the RDT&E community.

- Mission planning is more directly associated with a single service in accordance with both precedent and law. However, overlapping responsibilities are manifested in several areas, and an improved process for communicating plans to meet mission objectives throughout DOD is desirable to the maintenance of a cohesive program. Similarly, the communication of planning material to the Congress should be enhanced by consolidating planning information concerning the ten missions identified above.
- Planning with allies promises to play an important role in the future as resource limitations and the realities of interdependence are further understood. Defense RDT&E planning, if appropriately juxtaposed with U.S. technological base and mission planning, could serve to strengthen the alliance. As a drive to both military force modernization and economy of effort, RDT&E provides a useful mechanism to revitalize the partnership from the base up and to strengthen the political coupling to Europe. The United Kingdom and West Germany have particularly strong research and development capabilities which could provide the focal points for new initiatives. In the Far East, Japan is the high-technology nation whose cooperation might well be sought in an RDT&E planning arrangement to further both nations' interest. In the Middle East, Israel provides an opportunity for joint "T&E" efforts based on combat experience with modern U.S., allied and adversary weapons. Comprehensive RDT&E planning with these allies in mutually acceptable areas could do much to recement the alliance and, over the long term, provide a sound basis for compatible military, political, and economic strategies.
- The need for consolidated plans on the use of finances, manpower, facility, and materiel is being driven by both the Administration and the Congress. These drives are precipitated by scarcities that are unlikely to be alleviated in the foreseeable future. Joint planning in this area is also desirable from the viewpoint of developing a comprehensive understanding of the future limitations that may be placed on the RDT&E program and should result in the optimum use of available resources.
- Organizational planning is usually accomplished within DOD, without benefit of long-range organizational objectives or comprehensive assessments to provide a unifying concept. Changes may occur, for example, within a single service organization without a full understanding of the accompanying impact upon the RDT&E program and other elements of the official community. The purpose of developing organizational objectives is to ensure the efficient management or implementation of the overall RDT&E effort. Plans for organizational adjustments would be based on information derived from technological base, mission, and resource plans.

From the five elements of total RDT&E planning can be derived plans for joint service activities, and most importantly, the components facilitate the development of a closer working relationship with U.S. industry.

VI NEW DIRECTIONS IN DEFENSE R&D PLANNING

The parameters of an R&D strategy have been previously identified as national security and defense RDT&E goals and guidelines, assessments and constraining factors, RDT&E objectives, and total RDT&E planning. These four elements have been described in the preceding section of this report together with a review of defense planning systems. In proposing a revised approach to RDT&E planning, it is necessary to identify the relationship it bears to the existing force planning process. The basic relationships between the systems are shown in Figure 8.

Net assessment and net RDT&E assessment are shown connected by a solid line in the diagram to indicate the information and data exchange relationship that links these assessment functions together. Intelligence and opportunities (technological and otherwise), which are shown as a basic drive to both the assessments, are also characterized as "understanding" in the parameter relationship shown in Figure 9. Similarly, the solid line connections between forces and missions, and the RDT&E program to total planning, symbolize the planning relationship between current efforts and revised plans. In addition, the connection between forces and missions and the ongoing RDT&E program provides a base line input to net RDT&E assessment.

Figure 9 indicates diagrammatically the national security and RDT&E guidelines (understanding, military strength, international alliances, negotiations, and efficiency), net RDT&E assessments and objectives (mission, technological base, resource, and organizational), and total RDT&E planning (technological base, DTH, resource, organizational, allies, joint service and industry). These parameters have evolved from an evaluation of the international and domestic realities, and reflect the key interrelationship that must be established to provide an upgraded and revitalized RDT&E planning process.

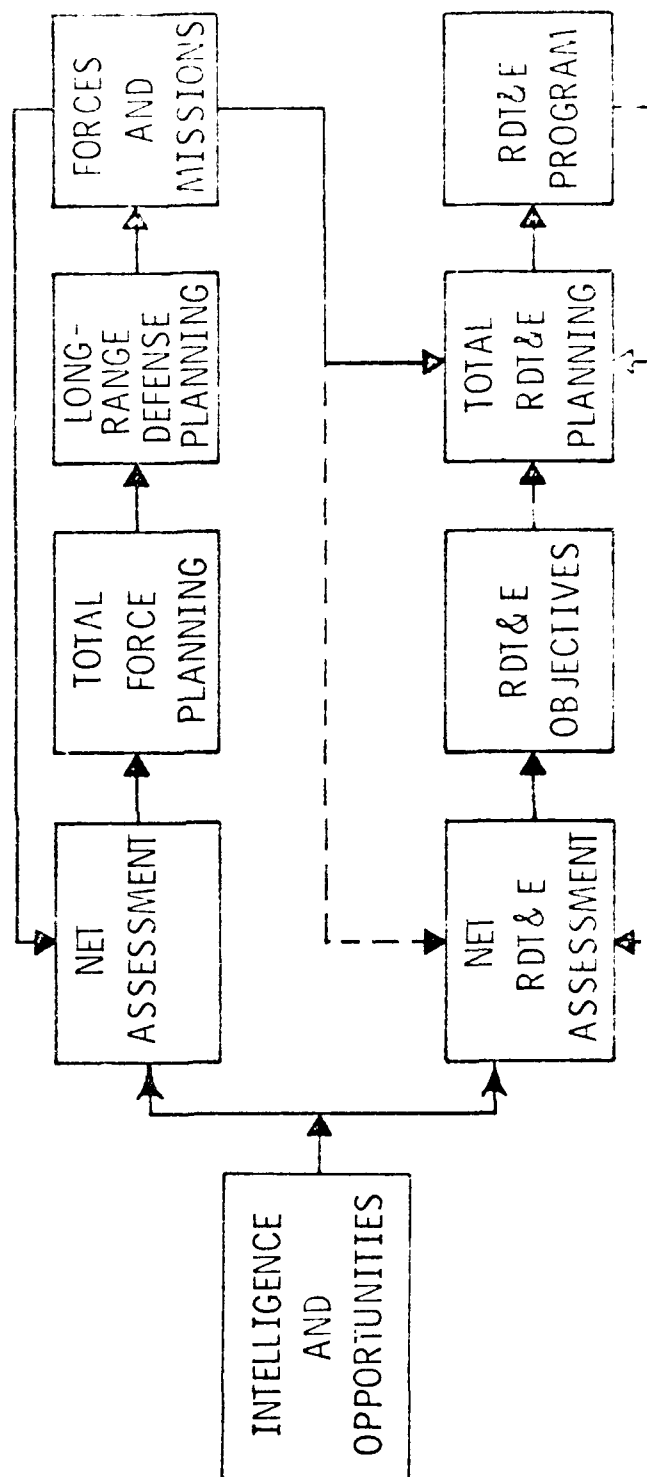


Figure 8. FORCE RDT&E PLANNING RELATIONSHIPS

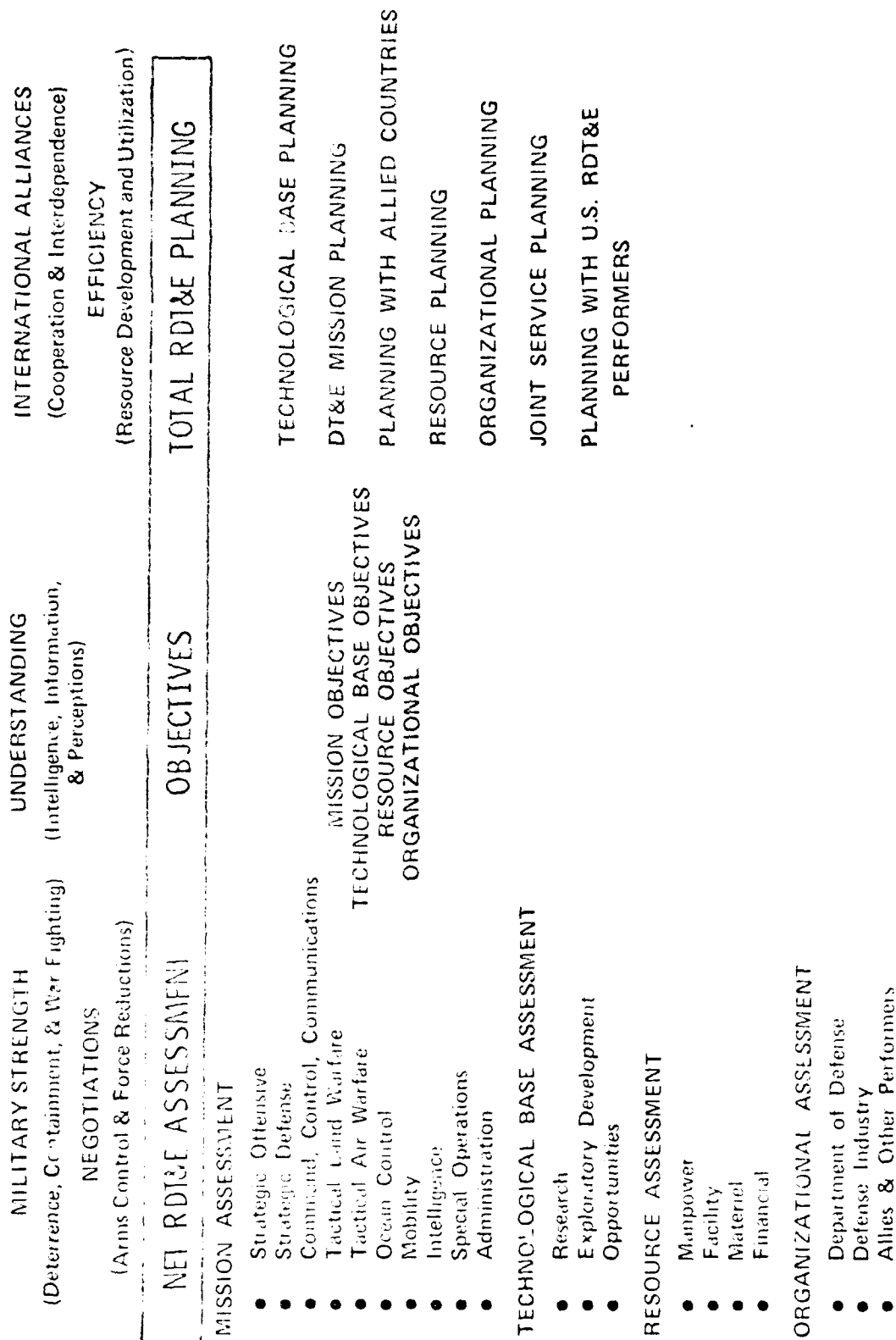


Figure 9 STRATEGY PLANNING PARAMETERS FOR RDT&E

National security goals are concerned with maintaining U.S. and allied strength to deter armed aggression and intimidation, to contain aggression if deterrence fails, and to wage total war only in the face of necessity. What changes is the strategy by which these goals are achieved. These changes are based upon perception of how much strength the United States needs to attain the goals and how the strength is to be maintained.

Today's defense posture is influenced by two basic drives: (1) the national drive to contain the arms race, a drive that has enabled us to be satisfied with strategic nuclear parity after years of strategic dominance, and (2) the national drive for economy in spending which constrains planners to a more precise definition of what constitutes an adequate defense. These drives place new demands on the R&D effort which must continue to guard against technological surprise and provide for long-term force modernization, yet spend less and avoid arms racing. Accurate assessment of needs is the key to maintaining long-term national security with a decreasing defense R&D budget. Four basic needs have evolved as critical to long term national security. These are: (1) the need for technological superiority in crucial areas to guard against technological surprise, (2) the need for maintaining technological balance in less crucial areas as a basis for general force modernization, (3) the need for R&D bargaining chips to provide the incentive for further arms control, and (4) the need for utilization of the total national and allied R&D effort. These needs represent the minimum requirements for maintaining a balance of power with the Soviet Union.

Two new goals have been added to the former national security goals of Military, International Alliances, Strength and Negotiation. These are Understanding and Efficiency. Understanding is meant in its broadest sense, to include the understanding of the capabilities and limitations of the United States as well as those of the adversary, and the understanding of the potential of science and technology. Understanding is a basic ingredient in the attainment of the other four goals but has been introduced as a separate goal to emphasize the need for more precision in

this age of force balance and economization. The goal of Efficiency pertains to the economic use of all national resources, including energy and ecology. Efficiency must be set forth as a goal because without it we have no governor on how resources are to be used in attaining the goals and no reasonable guidelines for selecting realistic R&D objectives. Increased emphasis on cooperation with allies for the purpose of R&D work sharing as well as force sharing is also essential to the efficient use of resources.

DISTRIBUTION LIST

ORGANIZATION	NO OF COPIES	ORGANIZATION	NO OF COPIES
ARPA/110 Advanced Research Projects Agency 1400 Wilson Boulevard Arlington, VA 22209	1		
Defense Documentation Center Cameron Station Alexandria, VA 22314	12		

<u>ORGANIZATION</u>	<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>	<u>NO. OF COPIES</u>
---------------------	----------------------	---------------------	----------------------